bridging the gaps
Sustainable Urban Spaces

Escalator Fund

UCL

Novel Nanostructures for Water Purification & Treatment

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Bridging the Gaps Sandpit: Little Green Things – Nanotechnology for Sustainability Challenges (£5,000)

This fund provided the opportunity to bring together a team with expertise on nano-structures and water treatment from London Center for Nanotechnology and UCL departments of Civil, Environmental and Geomatic Engineering and Physics. The main output from this initial project was a literature review on nanotechnology and water. The literature review pointed organic compounds such as humic substances and pesticides being contaminants of concern and Zinc Oxide and Clay were identified as potential nano-structures to be used in water technologies.

Figure 1 – Continuous Flow Photoreactor (CFP) and UV box

Bridging the Gaps Escalator Fund 2009 (£8,000)

This fund allowed us to get preliminary results on evaluating the effectiveness of Zinc Oxide and Clay for photocatalytic degradation of organic matter (i.e. humic acids). Tests were performed in batch (i.e. UV box) and continuous flow photo-reactors (CFP) to identify the efficiency of nano ZnO and Clay to degrade humic acids (Fig. 1). Continuous tests were performed under UV-A and UV-C, while batch tests were only possible under UV-A. From the batch tests, nano Clay was found to be not efficient to degrade humic acids and this was probably due the fact that these both compounds are negative charged. CFP results indicated that the photocatalytic performance of the treatment process using UV-C irradiation was superior to the photodegradation of humic acid using UV-A irradiation owing to the higher oxidizing power of the UV-C irradiation yielding a greater production of hydroxyl radicals. (Fig. 2).

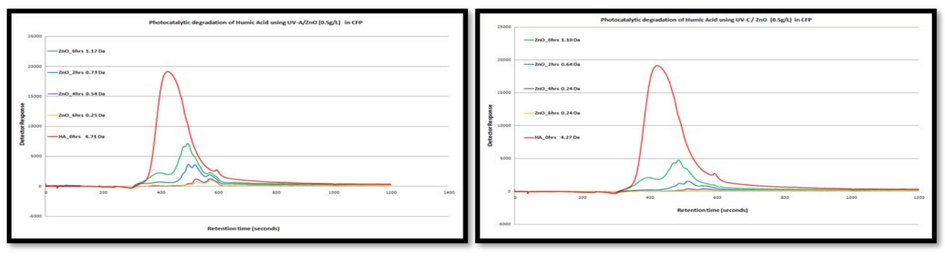

Figure 2 Photomineralisation of Humic Acid at UV-A/ ZnO 0.5g/L and at UV-C/ZnO 0.5g/L in the CFP

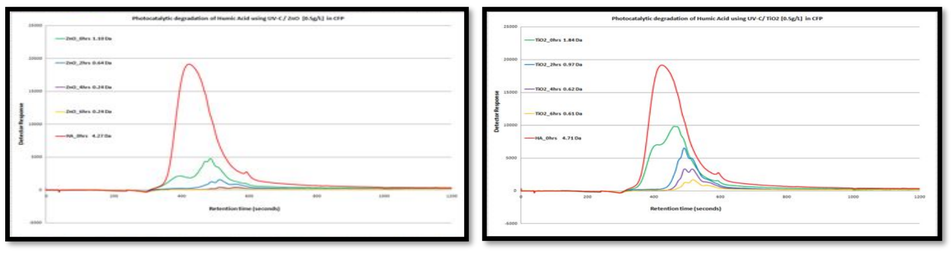

Figure 3 – Photomineralisation of Humic Acid at UV-C/ ZnO 0.5g/L and at UV-C/TiO_2 0.5g/L in the CFP

Bridging the Gaps Escalator Fund 2010 (£ 10,000)

Further tests were performed in CPF to compare the efficiency of ZnO and TiO2 for humic acids removal. Results showed that at a fixed concentration of 0.5g/L using UV-C ZnO proved to display a higher removal efficiency compared to TiO2. TiO2 suspended particles blocked the passage of UV-C irradiation thus achieving lower HA degradation (Fig. 3). Also tests were carried to synthesize nano ZnO and Laponite gel (type of clay) to be tested for the simultaneous removal of organic contaminants. The semi-AMPL(Automated Mass Production Line) was used for producing ZnO/Laponite pellets (Fig. 4). The synthesised material will be used for testing the simultaneous degradation of humic acids and pesticides under natural light during an MSc project from April August 2011.

Figure 4 – Semi-AMPL and pellets of ZnO/Laponite composite